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Towards X-ray imaging at GHz frame rates

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*Abstract for 19th Topical Conference on High-Temperature Plasma Diagnostics
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Fast X-ray imaging finds many applications in experimental studies of dynamical phenomena using coherent photons from synchrotron radiation and X-ray free electron lasers (XFEL), or incoherent photons from high temperature plasmas. In high temperature magnetized plasmas and laser driven plasmas, X-ray imaging provides information about X-ray radiation field which can be used to understand temporal evolution of plasma and solid structures. The existing imaging frame rates are limited to about 1 MHz. Faster imaging techniques up to GHz can capture faster dynamic processes such as sonic motion across granular features of materials or density inhomogeneities of samples which happen in nanoseconds. These techniques would turn X-ray imaging from a passive monitoring tool into a sensing technique that can potentially provide feedback control as materials become plasmas. We first discuss various imaging techniques that would be useful for fast X-ray imaging and identify the requirements on X-ray detectors. Then we discuss possible pathways towards X-ray imaging at GHz frame rates.